

KNOWASTE TECHNOLOGIES INC.

PILOT FACILITY

FINAL REPORT

OCTOBER 1993

Released Oct 11/93



Ontario

**Ministry of
Environment
and Energy**

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KNOWASTE TECHNOLOGIES INC.
PILOT FACILITY FINAL REPORT

OCTOBER 1993



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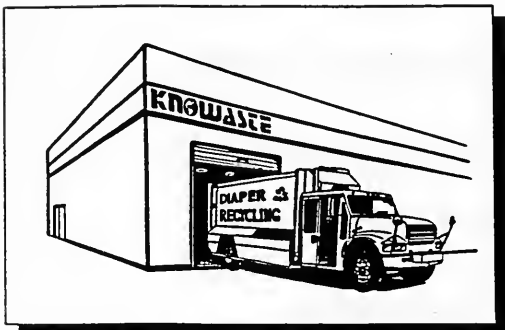
In May 1991 the diaper recycling project advanced to the pilot scale in order to further demonstrate the diaper recycling technology. A one tonne per week capacity recycling line was constructed and completed in August 1991.

The pilot stage of the project has been successfully completed.

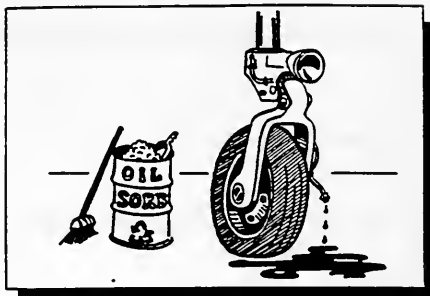
Objectives:

1. Design and construct a pilot recycling system to demonstrate the recycling technology.
2. Secure all Environmental permits required to operate a pilot plant.
3. Secure resources needed to engineer and construct a full scale facility.
4. Operate the recycling system for a period of ten months.
5. Implement diaper recycling within the Toronto Hospitals.
6. Collect soiled diapers from four Toronto Hospitals.
7. Compile the results of testing in areas of microbiology, effluent and product characterization of recycled pulp.
8. Manufacture new diapers/adult pads using the wood pulp recovered from the pilot project.
9. Test new diapers/adult pads back in hospital environment to complete product life cycle and demonstrate "closed loop" potential for recycled wood pulp.

The Diaper Recycling Process



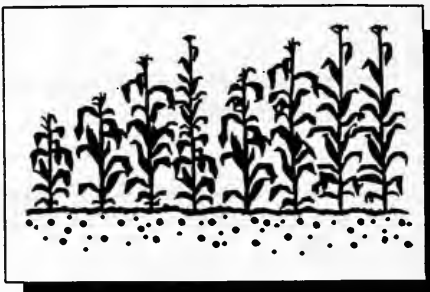
Once the diapers enter the Knowaste recycling system the human waste is washed out and discharged into the municipal sewer system where it will be properly treated. The diapers are washed, sanitized and separated into three material streams: wood pulp, mixed plastics and super absorbent. These materials are converted into new products.



The mixed plastics may be converted into an oil sorbent for industrial spills.



The fluff wood pulp may be re-used in new paper products like fine paper, tissue and diapers.



The super absorbent may be charged with nutrients and used in agricultural applications.

1. THE PILOT SYSTEM

The Knowaste system has been developed based on the premise that the recovered fluff wood pulp found in a diaper had sufficient integrity to re-enter the diaper manufacturing process.

The purpose of the pilot was to allow our development team to work through the practical challenges of building and operating a facility before constructing a large scale system. The pilot was instrumental in demonstrating the technology and securing the resources to build a full scale facility.

In August 1991, a pilot line to recycled soiled disposable diapers and personal care products was completed. The pilot had an initial capacity of 200 diapers per batch.

In February 1992, the pilot was enhanced to increase capacity ten-fold or 2000 diapers per batch. The expansion reflected a full scale separation unit. This gave the development team an opportunity to work extensively with a large scale configuration prior to the final engineering and plant layout stages.

The pilot provided opportunity to test various equipment and chemical formulae and greatly enhanced the optimization of the process. The goal of the system is to clean and separate the materials within disposable personal care products in a manner that is environmentally passive.

We have been able to demonstrate diaper recycling effectively by maintaining collection from the pilot hospitals, conducting tours and demonstrations to government, interest groups and the industry. The engineering for the full scale facility was completed in July 1992.

2. ENVIRONMENTAL CERTIFICATES

All permits to operate the pilot line were secured by September 1991. A permit to operate a system to process soiled material requires the approval of both the Regional and Provincial governments.

We met with the following officials from the Region of Peel:

Ed Vismantas; B.Sc., C.Chem. Manager Waste and Water Pollution Control.
Stephen Runowski, B.Sc, Technical Analyst Industrial Processes.
Judy Glennie, B.Sc. Technician Industrial Process.
Waste Management Branch;
Frank Condlin, M.B.A., P.Eng, Director Waste Management.

We met with the following officials from the Provincial government:

R. Adcock, C.E.T, Area Supervisor Halton Peel District Central Region.
Gerry Healy, Senior Environmental Officer Central Region Oakville District Office.
A. Nemet, Senior Environmental Officer Halton- Peel District Central Region.

Research and Development Certificate of Approval

As no other diaper recycling technology exists, there were no established standards for comparison.

On August 23, 1991 the Ministry of the Environment issued to Knowaste a Research and Development Approval for the operation of the pilot line. Knowaste hopes to establish diaper recycling protocol through its pilot line efforts in development.

The formal submission to the Ministry of the Environment for the operational Certificate of Approval will encompass this report and is anticipated to be submitted by October 31, 1992.



1991 08 23

Knowaste Technologies Inc.
969 Derry Road East
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L5T 2J7

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L6H 3P1
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416/822-2566

Bureau 401
1235, chemin Trafalgar
Oakville (Ontario)
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416/844-5747
416/822-2566

Attention: Mr. Mark Groves

Dear Mr Groves:

Re: DIAPER RECYCLING - RESEARCH & DEVELOPMENT APPROVAL

We have reviewed your request to operate a pilot disposal diaper recycling system. We will allow the operation of this pilot system on a research and development basis under the following conditions:

1. This pilot program can operate for 10 months. The starting date shall be September 1, 1991, and the finishing date shall be June 30, 1992. The project is to be carried out at 150 Orenda Road in the City of Brampton.
2. The system shall process no more than 800 kg. of diaper waste per week.
3. Only certified waste haulers shall be used.
4. Only disposable diapers from hospitals with a contracted arrangement with Knowaste Technologies Inc. shall be processed in this pilot program.
5. During the processing of the disposable diapers, all practical steps shall be taken to protect the health of the employees and minimize odours.
6. There shall be no more than 300 kg. of soiled diapers on the site at any one time.
7. Knowaste Technologies Inc. shall obtain approval, in writing, from the Region of Peel for discharging waste effluent to sanitary sewer.

../2.

Knowaste Technologies Inc.

Page 2

8. Knowaste Technologies Inc. shall provide a letter of Credit in the sum of \$1,000.00 to ensure that funds are available for clean-up if the project fails. This letter of Credit shall be provided before the pilot project commences operation.
9. Knowaste Technologies Inc. shall provide the Halton-Peel District Office with a copy of any approvals issued by the Region of Peel to dispose solid materials in the Regional landfill.
10. Knowaste Technologies Inc. shall prepare a detailed report on the pilot project. This report shall include; amount of material processed, quality of the effluent, materials recycled, quality of the materials recycled and an estimate of the viability of the project. This report shall be submitted by September 1, 1992.
11. A Provisional Certificate of Approval shall be obtained for a full scale operation.

If you have any questions or concerns with these conditions, please do not hesitate to contact me.

Yours truly,



Robert Adcock, CET
Area Supervisor
Halton-Peel District

RA:smp

cc: F. Condlin, Region of Peel



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Knowaste Technologies Inc.
969 Derry Road East
Suite 102
Mississauga, Ontario

Attention: Mr. Douglas Gray

Dear Mr. Gray:

Re: Disposable Diaper Recycling

We have reviewed your letter of November 18, 1991, notifying us of the location and proposed starting date of your request.

We acknowledge that the project will be carried out at 1213 Lorimar Drive in Mississauga starting in the first part of December, 1991.

We would ask if you are requesting an extension to the finishing date of June 30, 1992, a letter requesting the extension be submitted for our consideration.

You should be aware that all requirements in our letter of August 23, 1991, must be met.

If you have any further questions or concerns, please do not hesitate to contact me.

Yours truly,

Robert Adcock, CET
Area Supervisor
Halton-Peel District

RA:mb



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1991 12 09

Knowaste Technologies Inc.
969 Derry Road East
Suite #102
Mississauga, Ontario
L5T 2J7

Attention: Mr. Douglas Gray, Marketing Manager

Dear Mr. Gray:

RE: DIAPER RECYCLING PROJECT

We have reviewed your request of December 2, 1991, for an extension of the finishing date for your diaper recycling project.

We will comply with your request and extend the finishing date to July 21, 1992. You should note that all other terms and conditions still apply to this project.

If you have any other questions or concerns, please do not hesitate to contact me.

Yours truly,

Robert Adcock, CET
Area Supervisor
Halton-Peel District

RA:jb

3. RESOURCES FOR FULL SCALE FACILITY

- i) Ministry of the Environment for Ontario Industrial 3R's grant for capital. Contract signed January 1992 - \$503,795
- ii) Equity partners - Caithness Environmental Management Inc., equity investment agreement signed with Knowaste Technologies in May 1992 - \$1,850,000
- iii) Ontario Development Corporation - \$350,000 term loan, 5-year. Agreement signed August 1992.

Total sources = \$2,703,795

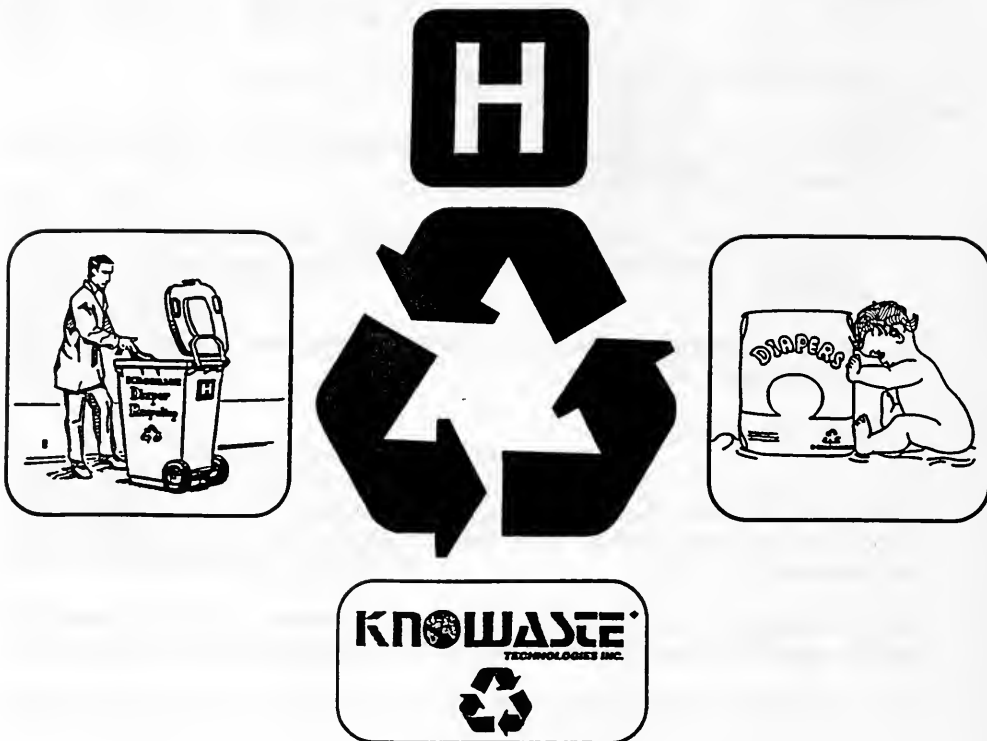
These resources will facilitate the construction of the full scale recycling line, building modifications and fund the optimization phase. The plant construction is underway and anticipated to be complete by January 1993 with operations set to commence early in 1993.

The optimization phase will focus on chemical and effluent reuse and recovered material specification enhancements for entry into high value end markets.

4. PILOT OPERATIONS

Press Conference

On January 21, 1992 Knowaste Technologies in conjunction with The Ministry of the Environment, The Ontario Hospital Association and Women's College Hospital held a press conference at Women's College Hospital. Knowaste announced the start-up of the pilot project with the four participating hospitals. The pilot phase was to develop the collection infrastructure, demonstrate diaper recycling, provide the engineering staff with a hands on development line and to demonstrate the end market suitability for the recovered wood pulp. The Ontario Hospital Association spoke positively of the recycling initiative and the benefits it would bring to the hospitals. The Ministry of the Environment announced a \$500,000 capital grant under the Industrial 3R's program to go towards the construction of the full scale facility.



The Pilot Hospitals

The following four Metro Hospitals agreed to participate in the pilot with Knowaste: The Hospital for Sick Children, Women's College Hospital, Toronto East General Hospital and The Baycrest Centre for Geriatric Care. The purpose was to observe the willingness of these institutions to participate in disposable diaper recycling.

The pilot began January 1992 and ran until June 1992. Collection is still being maintained.

5. IMPLEMENTATION OF DIAPER RECYCLING WITHIN THE HOSPITALS

The Toronto Hospitals each have their own Environmental Committee. This committee is made up of individuals from the Housekeeping Department, Purchasing Department, Medical Staff, Infectious Control and Maintenance Department. Their purpose is the "greening" of the Institution by implementing recycling and other waste reduction initiatives.

The hospitals are reluctant to use cloth diapers because of the reduced health care standards yet they must comply with the waste reduction goals of the province. The recycling of disposable diapers is the logical solution as it provides an alternative to cloth, landfill and incineration.

Attached are letters received from some of the health care institutions which demonstrate their interest in participating in diaper recycling. Also attached is a letter from Sancella Inc., the manufacturer of the newly converted underpads.

Handling the Soiled Diapers for Recycling

Removing the Diaper from the Patient

When a nurse removes a soiled diaper from a child or incontinent patient, the diaper is rolled up and taped closed. The urine has been absorbed by the super absorbent which minimizes leakage. Any liquids released by the feces are also trapped by the super absorbent. There is little chance of leakage once a diaper has been rolled and taped closed. This is a handling benefit when compared to cloth diapers. The diaper is then placed in a strong, clear plastic bag. The clear bag facilitates visual inspection of the materials. The nursing staff at the pilot hospitals have been very enthusiastic.

Transporting the Diapers to the Hospital's Storage Area

The housekeeping staff seal the bags and transport them to the storage area on Tuesdays, the day before collection. The Baycrest Centre for Geriatric Care, among others, already separate all of their diaper waste into bags which are removed from the rooms twice per day by the house keeping staff. In situations such as these implementation of diaper recycling is done with minimum behavior changes.

Storage at the Hospitals

The bags are placed in large plastic containers or bins with lids and stored in the waste storage area for collection.

Diaper recycling has been successfully implemented on a pilot scale in the four participating hospitals. Knowaste will undertake to secure diaper recycling in the remaining hospitals, elderly care giving institutions and daycare facilities in the Metro Toronto area during October - November 1992 to prepare for operations in January 1993.

6. COLLECTION AND HANDLING

L.W. Sandersons & Sons Ltd., a waste hauler from Brampton, Ontario, agreed to assist with the collection of the soiled diapers. The diapers were collected once per week on Wednesdays. The collector removes the bags of diapers from the container and loads them into the truck. The amount of material collected is restricted to 3 or 4 bags of diapers per week per hospital. A single collector was required to handle the diaper waste.

The collector visually inspects the bags through the clear plastic. If there are any contaminants such as dressings, cans or glass, the bag would not be removed from the hospital. No bags have had to be rejected. Overall the level of contamination was very low.

Handling the Diapers at the Plant

The bags of diaper waste are then unloaded by hand and prepared for processing. The operator places the diapers into a funnel-like opening. The process does not involve human contact from this point.

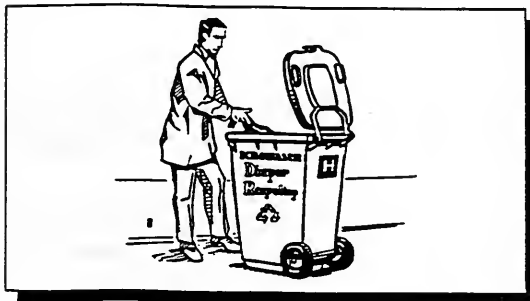
The machine operator is required to wear the following protective clothing:

- rubber gloves
- paper respirator
- rubber apron

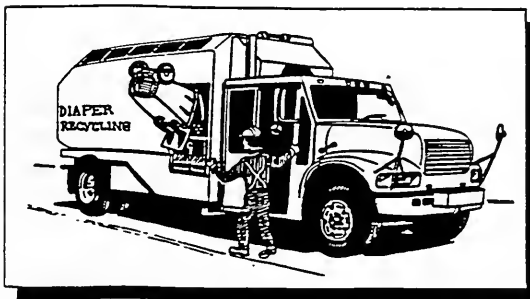
Diaper Waste Collected from Healthcare Institutions



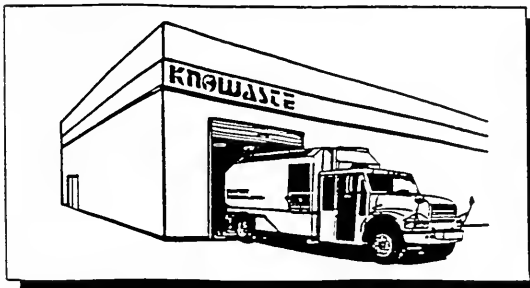
Source separation: Soiled diapers collected using a diaper pail lined with a standard collection bag.



Collected from the institution: Once the diaper waste has been sealed in the collection bag it may be placed in larger container for collection.



Collection: The diaper waste can be collected using a designated truck. This could be a small five tonne, single axle, single operator, collection truck.



Diaper recycling: The diaper waste may be delivered directly to the Knowaste facility. At the facility the diaper waste will be cleaned and processed into new raw materials.

7. TEST RESULTS

Testing was conducted in three primary areas:

1. Effluent
2. Microbial analysis
3. Wood pulp integrity - pulp, pads

The following organizations provided testing:

- Nucro-Technics - Analytical and Toxicology Lab
- Du Pont Canada - Research Lab
- EI Du Pont, USA - Research Lab
- Sancell Inc.

Please see testing sections appended to this report.

The Knowaste goal was to demonstrate that the post consumer recycled wood pulp would be of sufficient integrity to be utilized as a raw material for the conversion of new personal care products.

It was important to demonstrate the cleanliness of the pulp after the recycling and conversion processes. The following results, we believe, clearly substantiate our recycling process:

1. Effluent

The first area of testing deals with the effluent produced by the recycling process. The Regional Municipality of Peel, where the pilot and the subsequent full scale facility are located, is one of the most aggressive regions from an environmental perspective. For each element tested, the regional standard has been indicated. The test results for C.O.D.'s is an exception as no standard level is required on effluent within the region.

The testing consistently demonstrated that the effluent produced from the diaper recycling process was well within the limits set out in the Regional Municipality of Peel's Sewer Use By-Law 90-90.

2. Microbial Analysis

Nucro-Technics is one of Canada's leading analytical and toxicological testing facilities. All tests were conducted using the standard method of testing protocol.

Please note the test results were identical for both the recycled wood pulp and the new converted adult incontinent underpads (60% virgin/40% Knowaste recycled).

Please also note the testing incorporated the actual material which was recovered from the hospitals, recycled in our process, processed into fibre board and then converted by a commercial manufacturer of disposable personal care products into adult incontinent underpads.

3. Fibre Test Results

The fibre test results have been divided into two categories:

1. Recovered post consumer wood pulp

These results demonstrate absorption and capacity of the recovered pulp during 1990, 1991 and 1992. Testing was conducted by Du Pont Research Labs in both Canada and the United States. The basic premise of Knowaste Technologies that the pulp recovered from the recycling process would have sufficient integrity to be used as a raw material is supported by these findings.

2. Testing on newly converted adult incontinent pads

Sancella Inc. manufactured the pads using 40% Knowaste recycled and 60% virgin pulp. They then tested the pads with recycled content against those made with virgin materials. The results demonstrate the ease of use that Sancella experienced utilizing recycled material.

At present, these pads with recycled content are being tested in two of the hospitals participating in the pilot - Baycrest Centre for Geriatric Care and Toronto East General.

A formal evaluation questionnaire has been prepared for this phase of the pilot testing and the results will be added to this report at the end of September 1992.

8. RECOVERED RECYCLED FIBRE MANUFACTURED INTO NEW DIAPERS

To fully complete the product life cycle and demonstrate the recovered post consumer wood pulp's suitability for conversion of new personal care products, a test was established with Sancell Inc. to convert new products and test them within the hospitals.

In order to facilitate the conversion process, the fibre recovered from the pilot system was sent to Trois Rivieres in Quebec where it was converted into a paper roll. The newly converted roll was then sent to Sancell for re-manufacturing of underpads.

Recycled content in New Diapers and Incontinent Products

The roll of recycled fibre was placed on the converting line beside a roll of virgin pulp. The products that were made contained 60% virgin fibre and 40% recycled fibre. This blend was to increase the number of products for testing.

9. HOSPITAL TEST USING RECYCLED CONTENT

During September 1992, these products will be tested back at the hospitals. Sancell, regularly pilots new products within the hospitals. Using questionnaires and other information gathering devices, a thorough product evaluation is being completed. This test is significant in many ways. First, the new pads demonstrate the full life cycle of disposable diapers. Second, the test proves the quality of the recycled fibre. Sancell is a reputable manufacturer and their experience and established methods of product evaluation will enhance the entry of our recycled wood pulp back into the industry.

SUMMARY

The Knowaste recycling facility will be located in Mississauga Ontario. The system will have the capacity to run seventy five wet tonnes of diapers per day. It is anticipated that the baby diapers and incontinent diapers generated from sixty institutions in southern Ontario will be enough feedstock for one full shift. The average hospital produces approximately two tonnes of diapers per week. The in-hospital pad test is anticipated to be completed by the end of September. We will annex the results.

Knowaste Technologies was established to be a resource to the Sanitary Paper Products Industry and to develop innovate waste management solutions. We are confident that the results of our pilot line phase of operations establishes the feasibility of diaper recycling.

We commit to implementing diaper recycling on an institutional basis and will begin conducting municipal implementation programmes in the regions of Peel and Metro Toronto during the next year. We continue to develop and enhance the recycling process and will endeavour to continue to meet the long term needs of government waste management goals, industry needs and the public's utility and freedom of choice in sanitary protection.

APPENDIX A

EFFLUENT TESTING

Effluent Produced From Recycling Process
Knowaste Pilot
January 1992 – June 1992

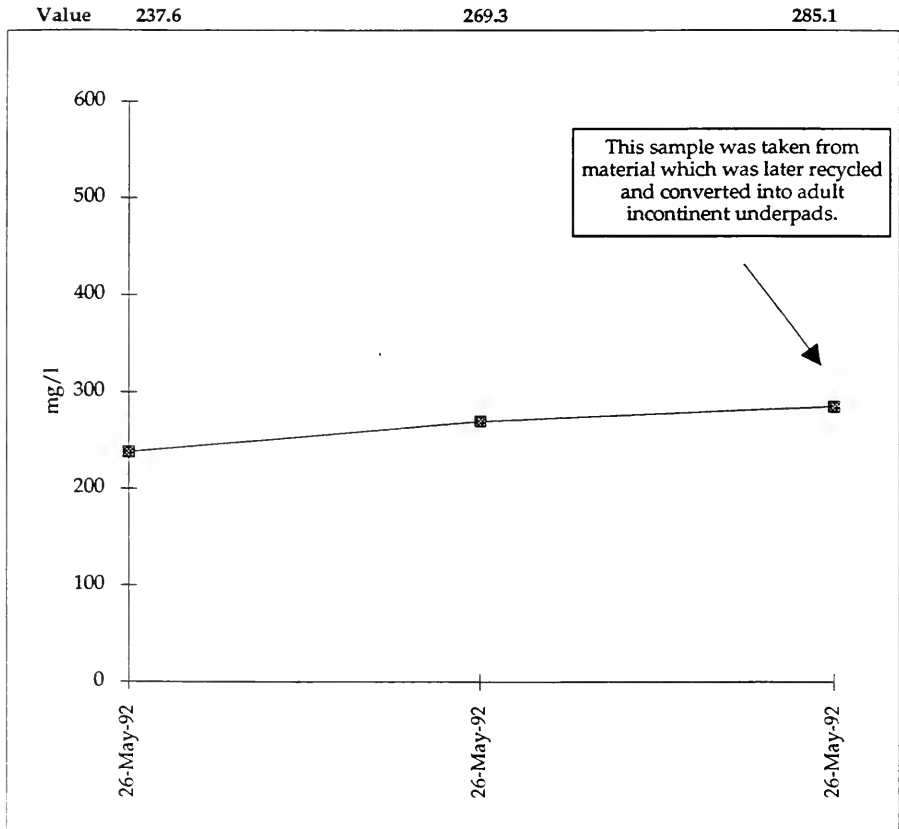
Date	Test	Result	Measurement	Standard	Variance	Comments	Action
26-May-92	C.O.D.	237.6	mg/litre	N/A	N/A		
	B.O.D. 1	20.4	mg/litre	300	279.6		
	B.O.D. 2	23.4	mg/litre	300	276.6		
	Suspended Solids	200.0	mg/litre	350	150		
26-May-92	C.O.D.	269.3	mg/litre	N/A	N/A		
	B.O.D. 1	20.9	mg/litre	300	279.1		
	B.O.D. 2	22.4	mg/litre	300	277.6		
	Suspended Solids	4.0	mg/litre	350	346		
26-May-92	C.O.D.	285.1	mg/litre	N/A	N/A	See Note 1.	
	B.O.D. 1	22.4	mg/litre	300	277.6		
	B.O.D. 2	26.9	mg/litre	300	273.1		
	Suspended Solids	72.0	mg/litre	350	278		

Standards are from The Regional Municipality of Peel's Sewer Use By-law 90-90 dated July 1991.
Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Notes:

1. This sample is taken from the material which was recycled and converted into adult incontinent underpads.

C.O.D. Levels In Effluent Produced From Recycling Process
Knowaste Pilot
January 1992 – June 1992

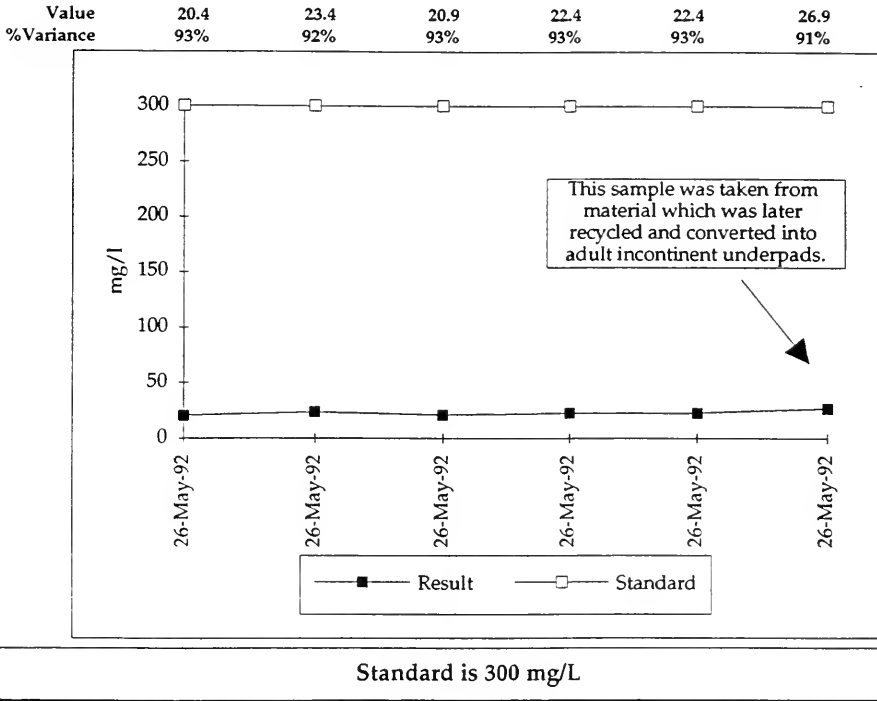


No standard is applied to C.O.D. levels.

Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Standards are from The Regional Municipality of Peel's Sewer Use By-law 90-90 dated July 1991.

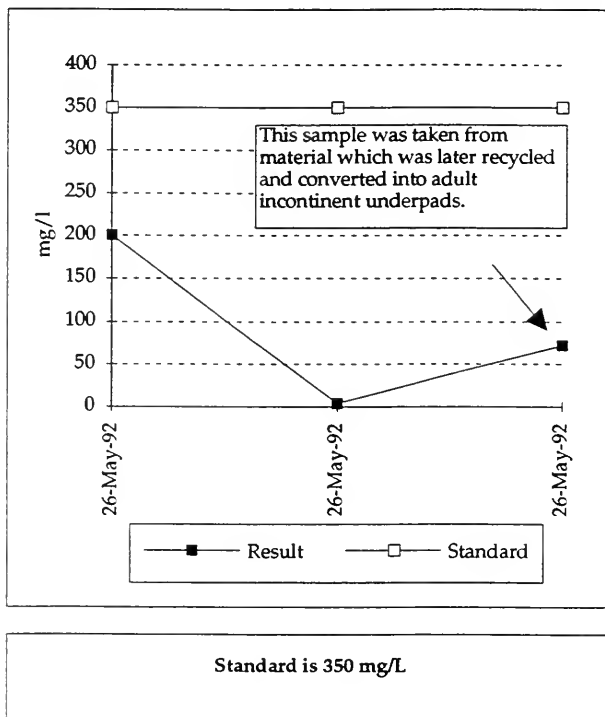
B.O.D. Levels In Effluent Produced from Recycling Process **Knowaste Pilot** **January 1992 – June 1992**



Tests were conducted at Nucro-Technics, Scarborough, Ontario.
 Standards are from The Regional Municipality of Peel's Sewer Use By-law 90-90 dated July 1991.

Suspended Solid Levels In Effluent Produced From Recycling Process Knowaste Pilot January 1992 – June 1992

Value	200	4	72
%Variance	43%	99%	79%



Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Standards are from The Regional Municipality of Peel's Sewer Use By-law 90-90 dated July 1991.

APPENDIX B

MICROBIAL TESTING

**Recycled Post Consumer Wood Pulp
Knowaste Pilot
January 1992 – June 1992**

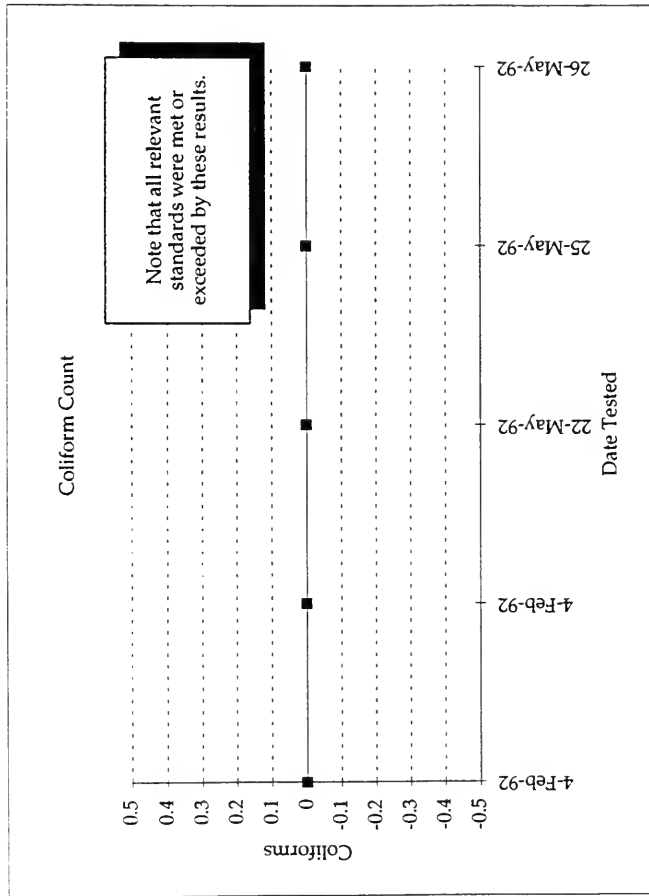
Date	Temperature	Coliforms	Fecal Coliforms	Aerobic Microbial Count	Comments
4-Feb-92	Refrigerated	Negative	Negative	Less than 10 Microorganisms per gram	
4-Feb-92	Room Temperature	Negative	Negative	Less than 10 Microorganisms per gram	
22-May-92	Room Temperature	Negative	Negative	Less than 10 Microorganisms per gram	
25-May-92	Room Temperature	Negative	Negative	Less than 10 Microorganisms per gram	
26-May-92	Room Temperature	Negative	Negative	Less than 10 Microorganisms per gram	See note 1.

Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Notes:

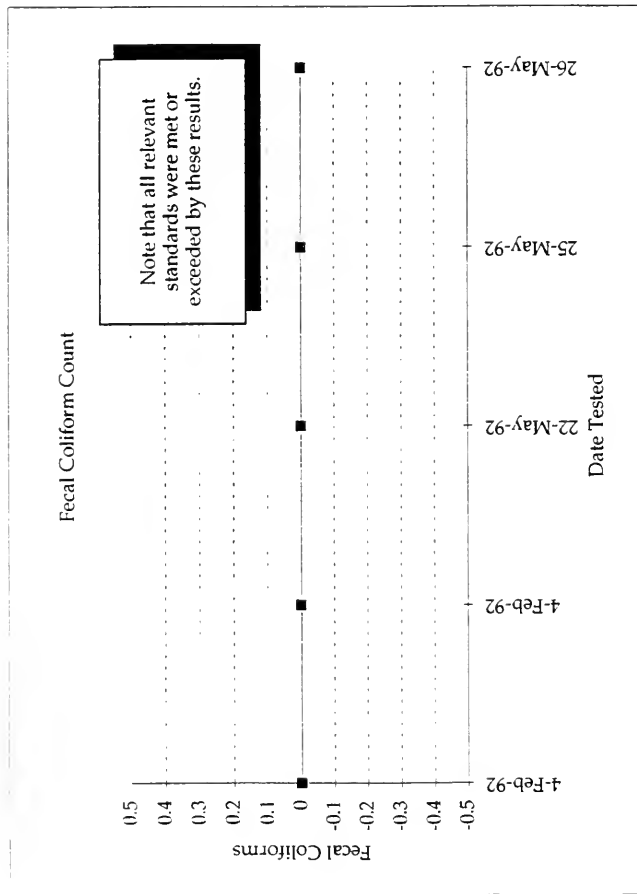
1. This sample is taken from the material which was recycled and converted into adult incontinent underpads.

Recycled Post Consumer Wood Pulp Knowaste Pilot January 1992 – June 1992



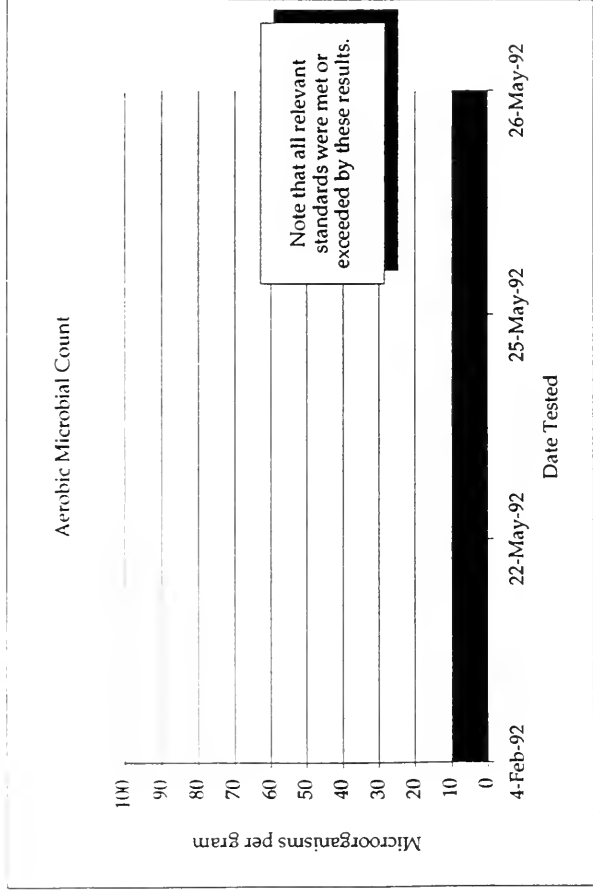
Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Recycled Post Consumer Wood Pulp Knowwaste Pilot January 1992 - June 1992



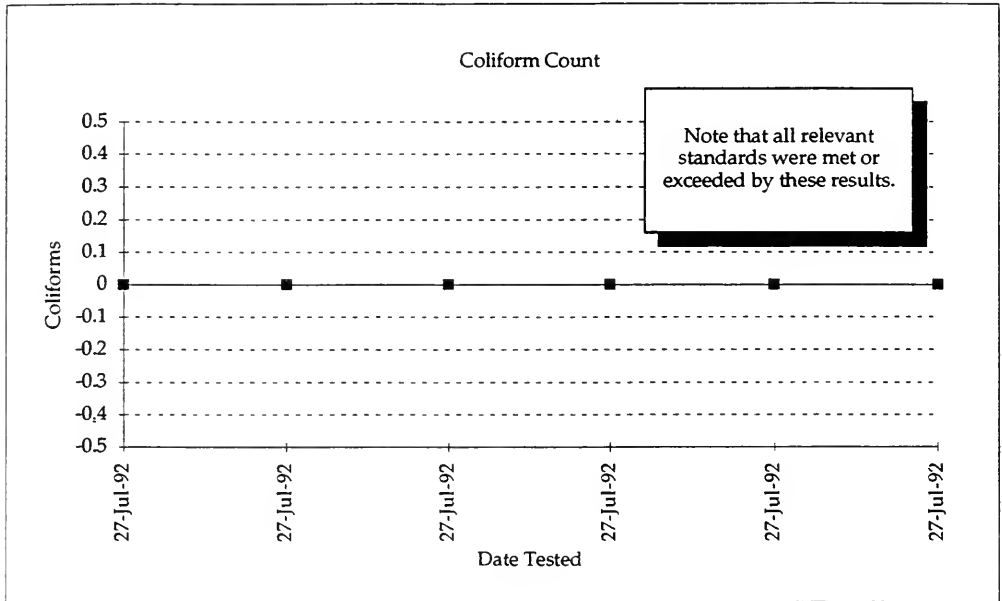
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Recycled Post Consumer Wood Pulp Knowaste Pilot January 1992 – June 1992



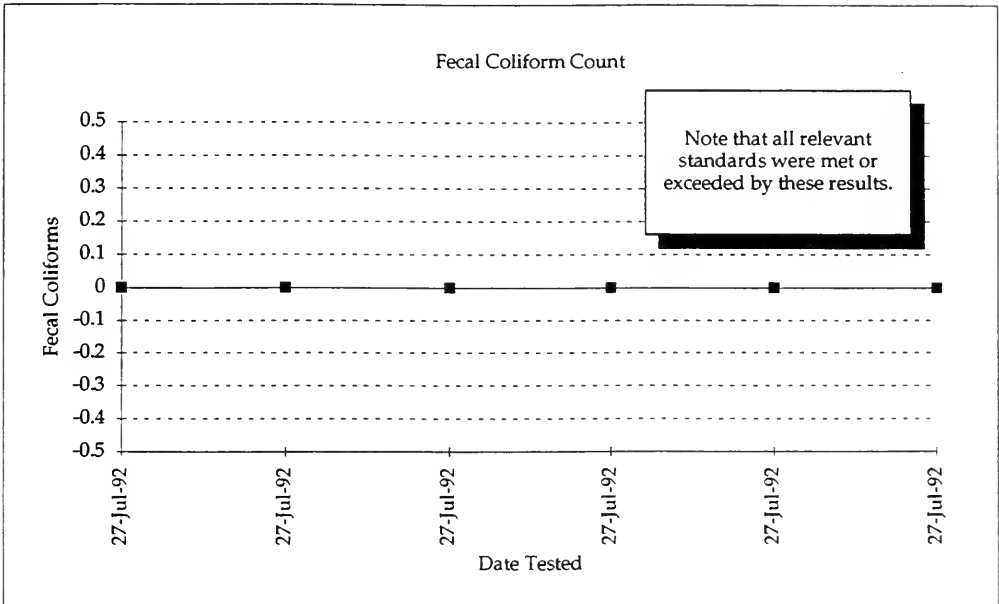
Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Freshly Converted Adult Incontinent Pads Composed of
40% Post Consumer Fibre and 60% Virgin Kraft Pulp
Knowaste Pilot Project
27-Jul-92



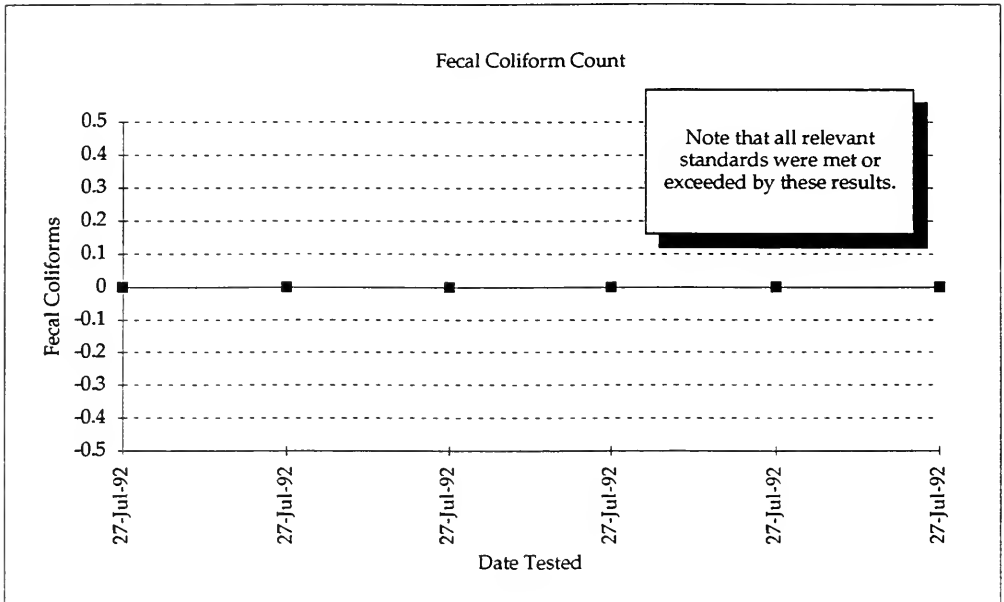
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Freshly Converted Adult Incontinent Pads Composed of
40% Post Consumer Fibre and 60% Virgin Kraft Pulp
Knowaste Pilot Project
27-Jul-92



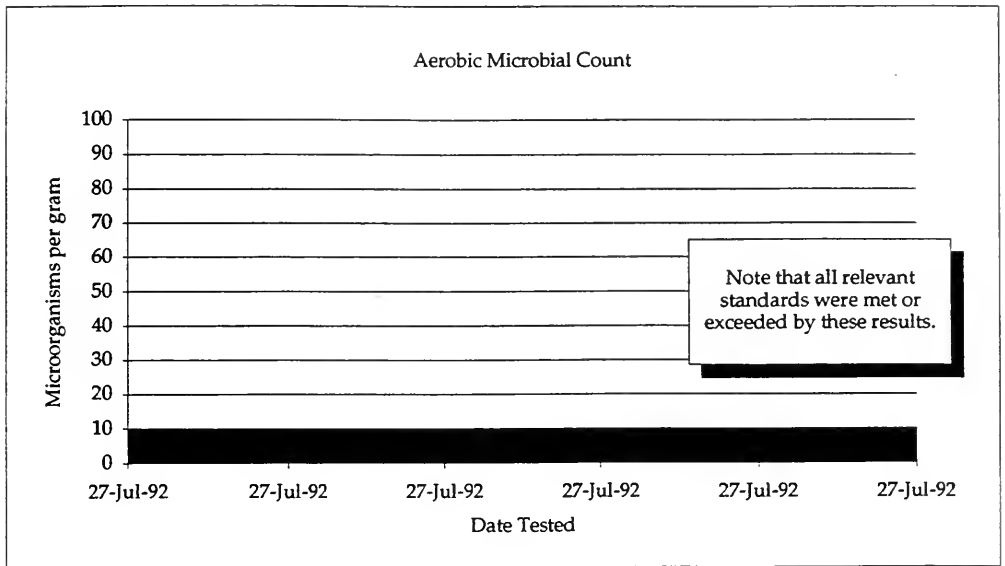
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Knowaste Pilot Project
27-Jul-92



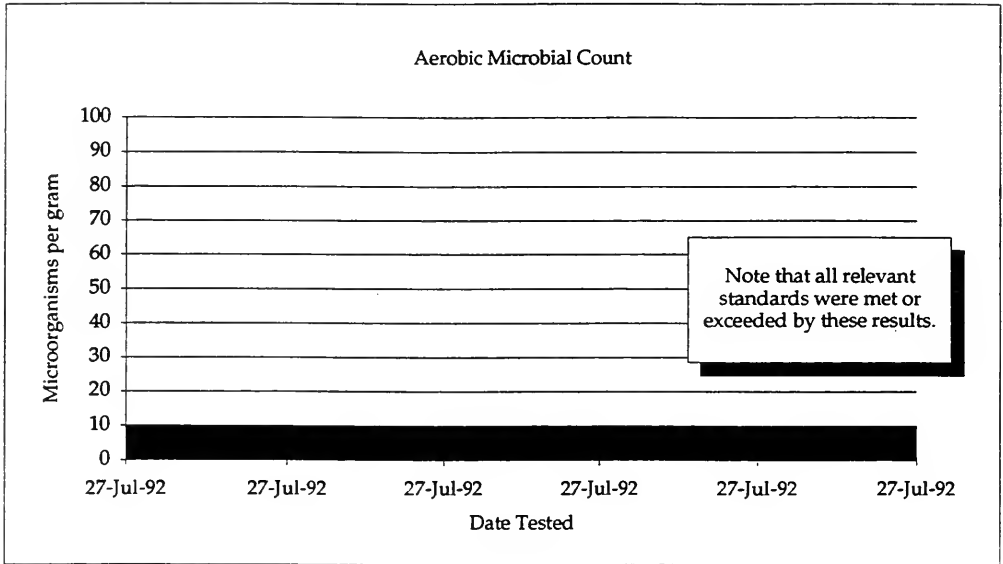
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Freshly Converted Adult Incontinent Pads Composed of
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Knowaste Pilot Project
27-Jul-92



Tests were conducted at Nucro-Technics, Scarborough, Ontario.

Freshly Converted Adult Incontinent Pads Composed of
40% Post Consumer Fibre and 60% Virgin Kraft Pulp
Knowaste Pilot Project
27-Jul-92



Tests were conducted at Nucro-Technics, Scarborough, Ontario.

APPENDIX C

WOOD PULP TESTING

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Below is a comparison of the Knowaste recycled wood pulp with virgin Kraft pulp.

Testing Period	Sample	Plexafil %	SAP %	Sink Time (Seconds)	Absorptive Capacity (g/g)	Comments
October 26, 1990	With SAP					See Note 1.
	Buckeye Virgin	10	10	1.48	20.91	
	Knowaste	10	10	1.37	20.91	
	Without SAP					
November 19, 1991	Buckeye Virgin	10	0	2.07	17.73	See Note 2.
	Knowaste	10	0	1.51	18.47	
	With SAP					
	Virgin Weyerhaeuser NB 316	7	10		19.4	
	Knowaste 1	7	10		17.8	
	Knowaste 1	7	10		16.2	
	Virgin Weyerhaeuser NB 316	7	10		16.5	
	Knowaste 2	7	10		16.0	
February 12, 1992	Knowaste 2	7	10		16.1	See Note 3.
	With SAP					
	Knowaste 1	10	10	1.35	17.37	
	Knowaste 2	10	10	1.27	17.34	
	Knowaste 3	10	10	1.31	17.43	
	Without SAP					
	Knowaste 1	10	0	1.67	14.76	
	Knowaste 2	10	0	1.56	14.33	
	Knowaste 3	10	0	1.60	14.38	

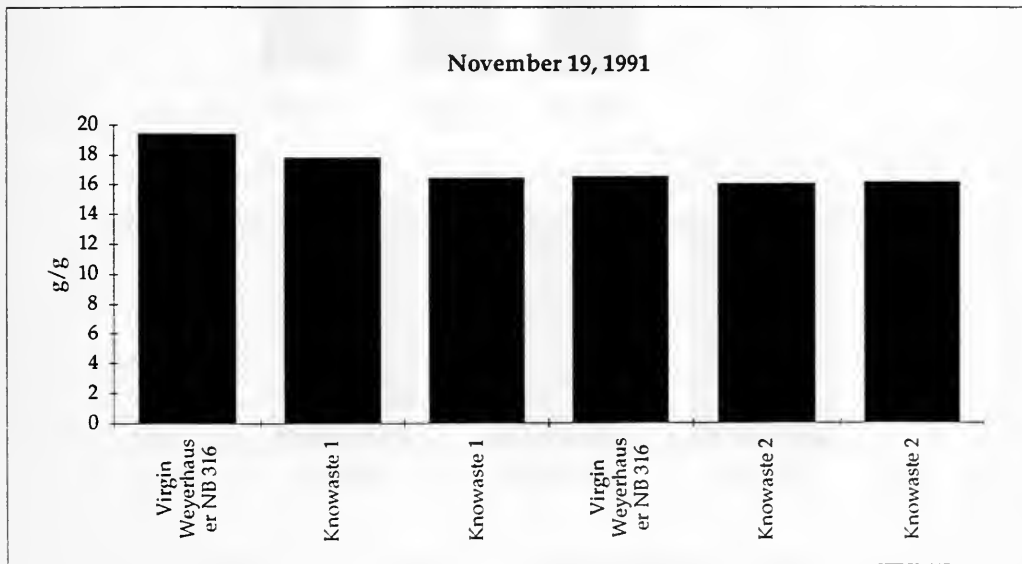
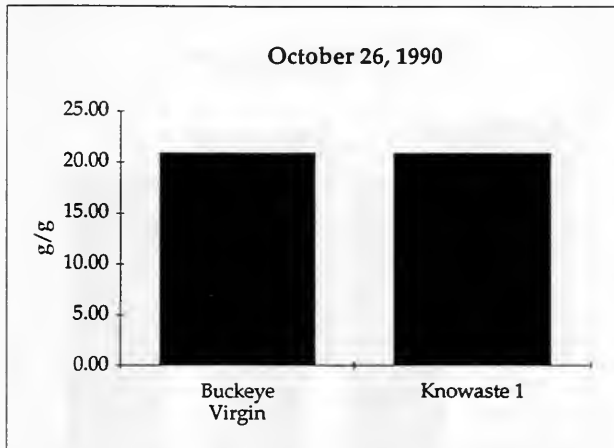
Notes:

1. October 26, 1990 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.
2. November 19, 1991 tests were conducted at El Du Pont Research Laboratory, Delaware.
3. February 12, 1992 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Comparison of the Knowaste recycled wood pulp with virgin Kraft pulp.

Absorptive Capacity with SAP

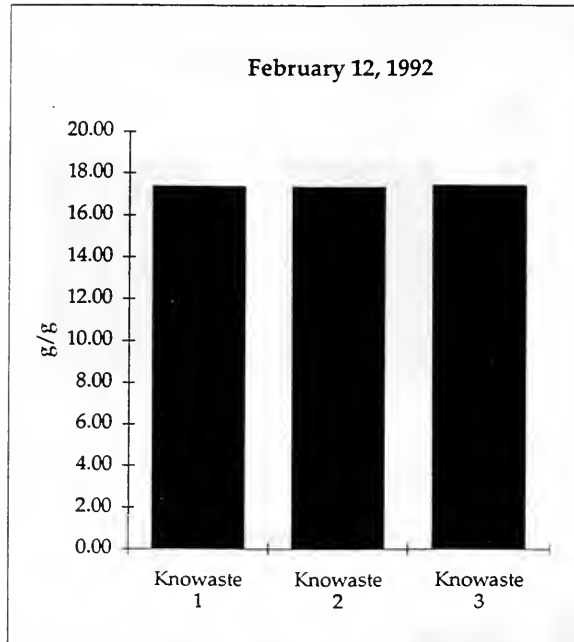


October 26, 1990 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

November 19, 1991 tests were conducted at EI Du Pont Research Laboratory, Delaware.

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Absorptive Capacity with SAP

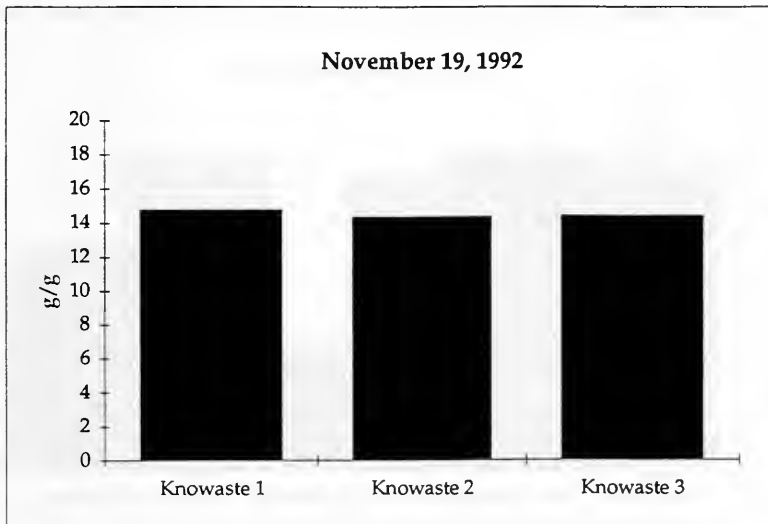
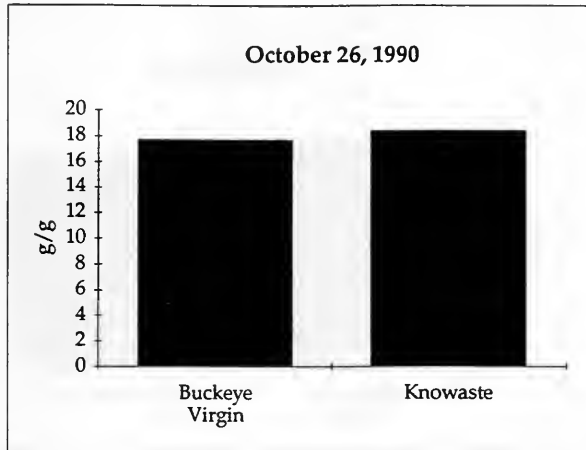


February 12, 1992 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Comparison of the Knowaste recycled wood pulp with virgin Kraft pulp.

Absorptive Capacity without SAP



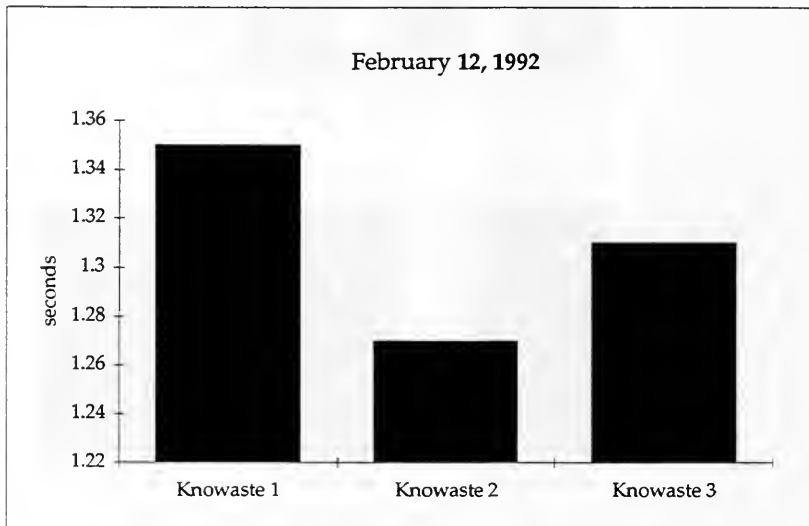
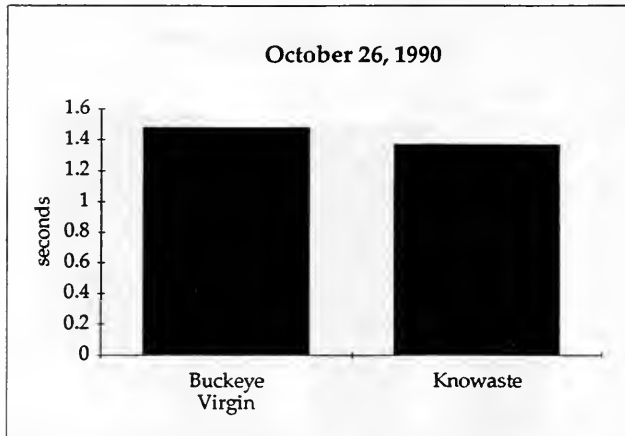
October 26, 1990 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

November 19, 1991 tests were conducted at EI Du Pont Research Laboratory, Delaware.

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Comparison of the Knowaste recycled wood pulp with virgin Kraft pulp.

Sink Time with SAP



Note: The faster time is desired.

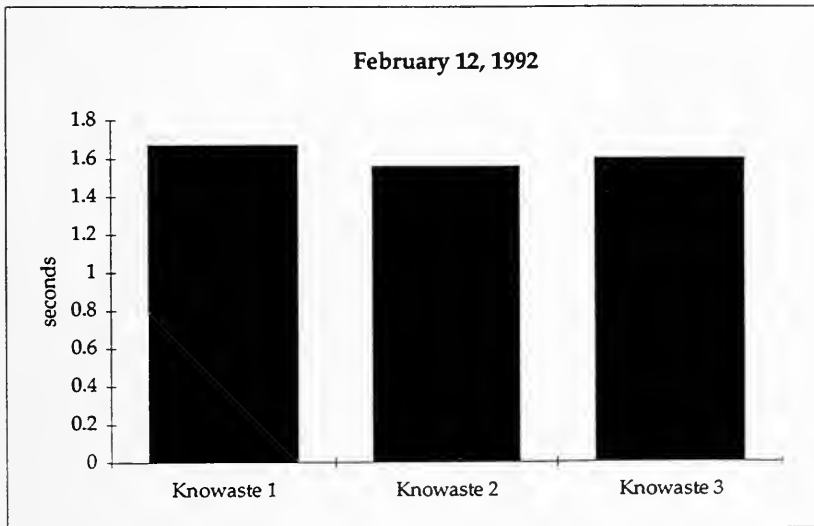
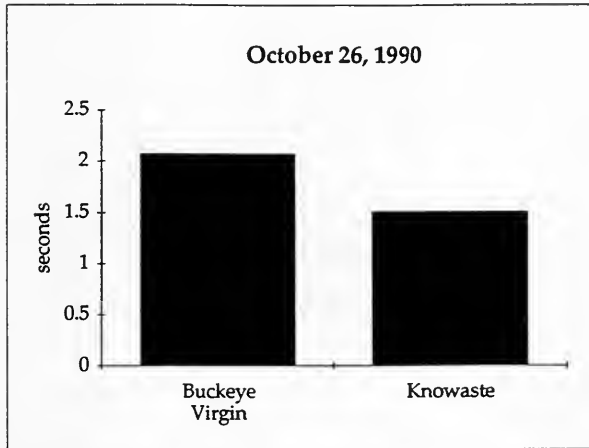
October 26, 1990 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

February 12, 1992 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

Knowaste Recycled Post Consumer Wood Pulp Fibre Test Results

Comparison of the Knowaste recycled wood pulp with virgin Kraft pulp.

Sink Time without SAP



Note: The faster time is desired.

October 26, 1990 tests were conducted at Du Pont Canada Research Lab, Kingston, Ontario.

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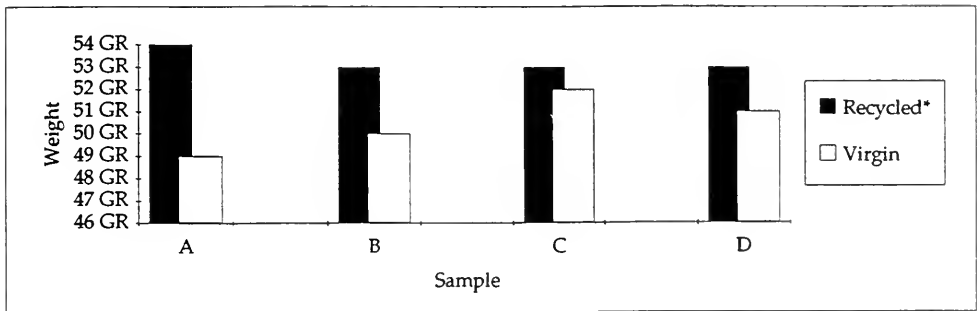
APPENDIX D
WOOD PULP PAD TESTING

**Absorbency Testing
Recycled Adult Incontinent Pad
Knowaste Pilot
January 1992 – June 1992**

<u>RX Samples</u>	Overall Underpad	Fluff Mat	Standard Absorption	Actual Absorption	Fluid Retention
01728 Brand 60% Virgin Pulp 40% Recycled Pulp	1 Weight Dry	2 Weight	3 Capacity	4 Capacity	5 GH ₂ O/G Pulp
A	54 GR	29 GR	348 GR	341 GR	11.8
B	53 GR	28 GR	336 GR	330 GR	11.8
C	53 GR	28 GR	336 GR	326 GR	11.6
D	53 GR	28 GR	336 GR	329 GR	11.8
<u>ORV Samples</u>					
01728 Brand 100% Virgin Pulp					
A	49 GR	24 GR	288 GR	292 GR	12.2
B	50 GR	25 GR	300 GR	333 GR	13.3
C	52 GR	27 GR	324 GR	320 GR	11.9
D	51 GR	26 GR	312 GR	301 GR	11.6
Note: Standard absorbency 12 grams GH ₂ O/Gram of pulp.					

Tests performed by Sancella Inc., a unit of Scott Health Care, Oakville, Ontario.

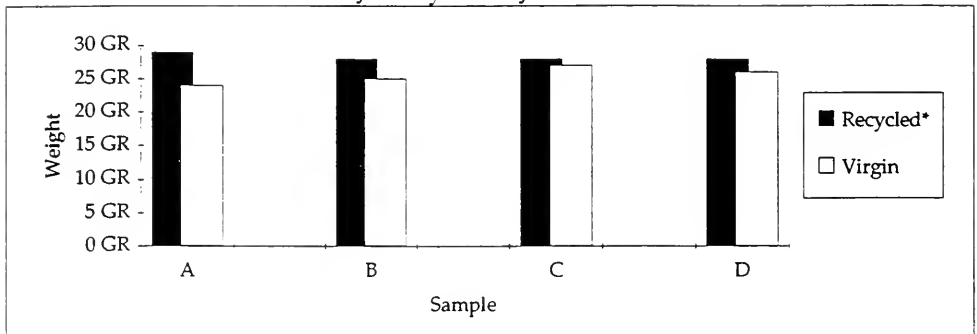
1
Absorbency Testing
Recycled Adult Incontinent Pad
Overall Underpad, Weight Dry In Grams
Knowaste Pilot
January 1992 – June 1992



*Recycled consists of 60% virgin pulp and 40% Knowaste recycled wood pulp.

Tests performed by Sancella Inc., a unit of Scott Health Care, Oakville, Ontario.

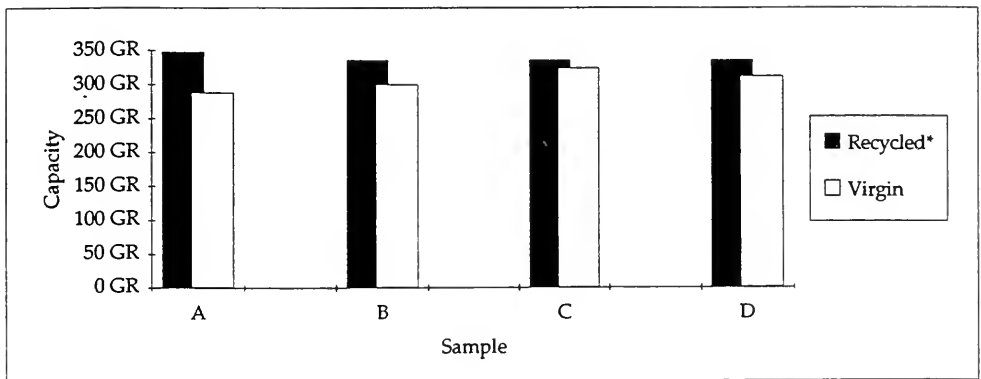
2
Absorbency Testing
Recycled Adult Incontinent Pad
Fluff Mat, Weight In Grams
Knowaste Pilot
January 1992 – June 1992



*Recycled consists of 60% virgin pulp and 40% Knowaste recycled wood pulp.

Tests performed by Sancella Inc., a unit of Scott Health Care, Oakville, Ontario.

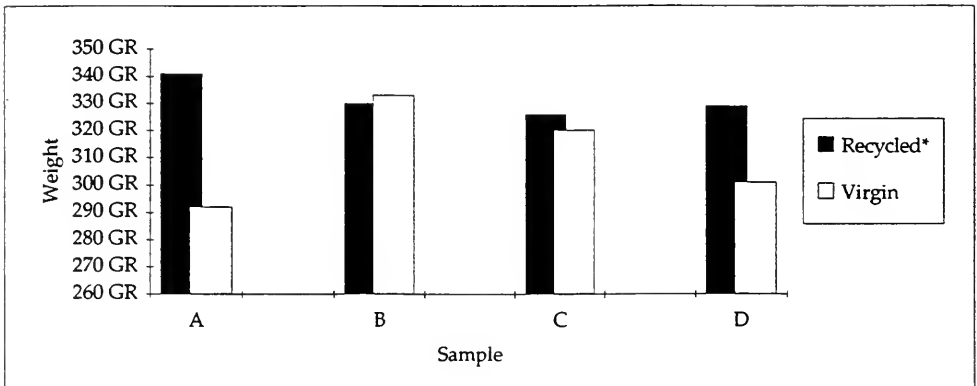
3
Absorbency Testing
Recycled Adult Incontinent Pad
Standard Absorbency, In Grams
Knowaste Pilot
January 1992 – June 1992



*Recycled consists of 60% virgin pulp and 40% Knowaste recycled wood pulp.

Tests performed by Sancella Inc., a unit of Scott Health Care, Oakville, Ontario.

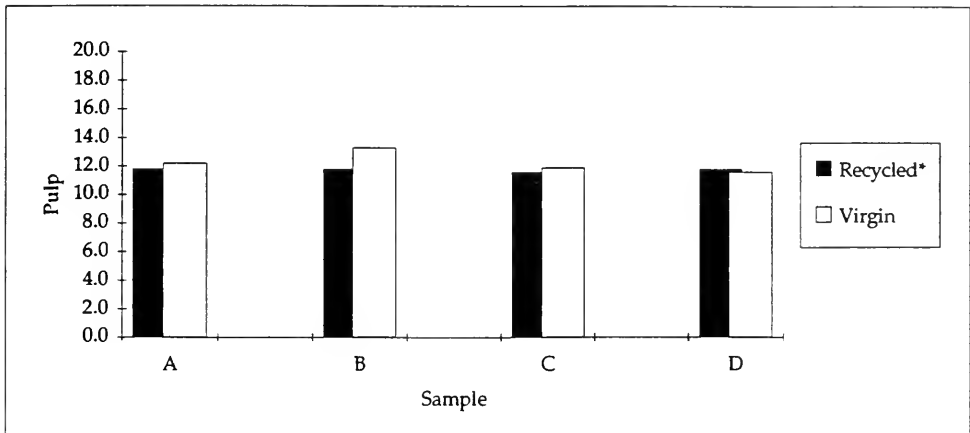
**Absorbency Testing
Recycled Adult Incontinent Pad
Actual Absorbency, In Grams
Knowaste Pilot
January 1992 – June 1992**



*Recycled consists of 60% virgin pulp and 40% Knowaste recycled wood pulp.

Tests performed by Sancell Inc., a unit of Scott Health Care, Oakville, Ontario.

5
Absorbency Testing
Recycled Adult Incontinent Pad
Fluid Retention
Knowaste Pilot
January 1992 – June 1992



*Recycled consists of 60% virgin pulp and 40% Knowaste recycled wood pulp.

Tests performed by Sancella Inc., a unit of Scott Health Care, Oakville, Ontario.

APPENDIX E

LETTERS OF INTEREST

ROYCE Co., Inc.
Technology and Machinery
for Cellulose Hygienic Products
Ocostrasse 20
CH-8437 Zurzach

Telephone 056/49 28 84
Telex 829 502 ROY
Telefax 056/49 19 61

royce®

9 September, 1992

Ms. Marlene Conway, President
Knowaste Technologies, Inc.
1213 Lorimar Drive
Mississauga, Ontario, Canada
L5S 1M9

Dear Ms. Conway:

The information in the Knowaste Stage 3 Pilot Facility Final Report, 31/8/92, on process safety and end product functionality was quite positive and warrants scale up to a demonstration plant.

It seems to me that Knowaste developed as much technical information on effluent quality and microbial content of the recycled pulp as is practical from a pilot facility of this size. Your data indicate that effluent contaminants are at 1/5 to 1/10 the Peel Standards. Absorbency testing of the recycled pulp in laboratory samples and in incontinent pads showed only modest differences from virgin kraft.

As you know, I have participated in technical discussions with the Knowaste Staff and assisted in pulp product evaluations over several years. From this viewpoint, and the data in the August 31 Report, I recommend going forward with construction of a demonstration plant.

Yours truly,



Kenneth R. Williams,
R & D Manager



Sancella Inc.

6-2300 Bristol Circle
Oakville, Ontario L6H 5S2
Tel: (416) 829-3737
Fax: (416) 829-3688

MARGO SKINNER
Director of Marketing

May 15, 1992

Mr. Doug Gray
Director of Marketing
Knowaste Technologies Inc.
1213 Lorimar Drive
Mississauga, Ontario
L5S 1M9

Dear Doug:

Thank you for the update on Knowaste diaper recycling technology. As we have discussed both in person and subsequently by telephone, Sancella will be pleased to work with you in testing recycled pulp, reclaimed from your pilot project, using some of that pulp initially in underpads which will be manufactured in our Oakville facility.

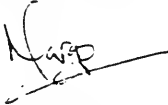
The work on this project should proceed with Ray Smollett and with Betty Brisco.

In regards to your other request and your need for a marketing partner to work with you in product and material testing as your project comes to commercialization, I have discussed this opportunity with John Clement, President of Scott Health Care and Bill Myers, President of Sancella. As you know we are going to become, by the end of May, a part of a newly formed company called Scott Health Care, which is a joint venture between Molnlycke and Scott, Philadelphia. We are excited about the opportunity to work with you in this regard, but would simply ask that you give us some time to formalize the arrangement, since as you can imagine all of our personnel are highly involved in the merging of the two companies plus the acquisition of the adult incontinence business of Weyerhaeuser.

I passed on the package of material which you gave me to John Clement, President of Scott Health Care, and I understand he has given it to Joe Bicho, who is Director of Technology for Scott Health Care. I am sure that at the first opportunity members of the Scott Health Care Technology Group will be interested in discussing this project with Knowaste Technologies and in visiting the site here.

I will be away from the business from May 17th until June 12th inclusive, and I look forward to talking to you upon my return.

Yours very truly,

A handwritten signature in black ink, appearing to read "Margo Skinner", with a long horizontal flourish extending to the right.

Margo Skinner
Director of Marketing

cc: **John Clement, President, Scott Health Care**
Bill Myers, President, Sancell Inc.
Joe Bicho, Director of Technology, Scott Health Care
Ray Smollett, Manufacturing Manager, Sancell Inc.
Betty Brisco, Product Manager, Sancell Inc.

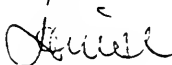
July 17, 1992

Mr. Doug Gray
Marketing Manager
Knowaste Technologies
1213 Lorimar Drive
Mississauga, Ontario
L5S 1M9

Dear Doug:

Please forgive my delay in writing this letter. St. Michael's Hospital would be interested in participating in The Diaper Recycling Program when you begin later this year.

Sincerely,



Louise Gibson
Chair
Recycle and Reuse Committee
St. Michael's Hospital

LG:uc

THE ETOBICOKE GENERAL HOSPITAL

101 HUMBER COLLEGE BLVD. • ETOBICOKE, ONTARIO M9V 1R8 • TELEPHONE 747-3400



Douglas A. Gray
Knowaste Technologies Inc.
1213 Lorimar Drive
Mississauga, Ontario
L5S 1M9

June 18, 1992

Dear Douglas,

I thank you for taking the time to explain to me the disposal diaper recycling program.

I would like to re-affirm that Etobicoke General Hospital is definitely interested in it and would like to keep updated concerning it's status and final construction of the necessary facility.

Attached is the annual usage disposables within Etobicoke General Hospital.

I look forward to hearing from you.

Sincerely,

A handwritten signature in black ink that reads 'Michael P. Malone'. The signature is fluid and cursive, with the first and last names being more prominent.

Michael P. Malone
Director of Housekeeping

mpm/et



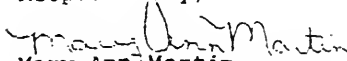
June 9, 1992

Dear Mr. Gray,

Sunnybrook Health Science Centre is very interested in being part of the recycling program that you have discussed with us. At the present we are running them through our sani-pak and sending them out with the regular waste.

At this time I do not have the information regarding the consumption of incontinent products but will forward them on to you when we do.

Respectfully,


Mary Ann Martin

Waste Management Coordinator

MEMORANDUM

To: Whom it may concern

From: John Meadows
Housekeeping Services
The Toronto Hospital

Re: Knowaste Diaper Recycling plan

Date: 27 April, 1992

We in the Housekeeping Services department of the Toronto Hospital have examined the Knowaste Diaper recycling proposal, and believe it to be a viable system for the environmentally responsible handling of such material.

We have met with company representatives, and have expressed our interest in further exploring the setting up of such a program at the Toronto Hospital when Knowaste is in a position to offer its services on a full scale basis.

Notwithstanding the forgoing, this letter is intended as a indication of interest only, and the hospital expressly disclaims any binding commitment to enter in to any arrangement with Knowaste, Inc., until such time as a mutually satisfactory arrangement is negotiated.



John Meadows
Training/Development Coordinator
The Toronto Hospital

BLOORVIEW

Caring for disabled young people since 1899.

April 15, 1992

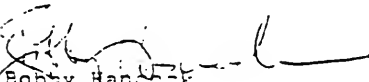
Mr. Doug Gray
Knowaste Technologies Inc.
1213 Lorimar Drive
Mississauga, Ontario
L5S 1M9

Dear Mr. Gray:

Thank you for your visit to Bloorview on March 27, 1992. We were pleased to see the progress your company is making regarding the recycling of soiled disposable diapers and incontinent pads. If your volume expands in the near future or if you are looking for another hospital for the trial period I'd appreciate you considering Bloorview as a source for recyclable material. We can either start with one unit or several rooms as I feel confident we could initiate such a program at Bloorview.

Again, thank you for your visit and the raw material samples you provided for our recycling display.

Sincerely,


Bobby Hancock,
Director
Environmental Services



**TORONTO
EAST
GENERAL AND
ORTHOPAEDIC
HOSPITAL INC.**

825 COXWELL AVENUE
TORONTO, ONTARIO
M4C 3E7
461-8272

9 September 1991

Mr. Douglas Gray
Knowaste Technologies Inc.
102-969 Derry Road East
Mississauga, Ontario
L5T 2J7

LETTER OF INTENT

Dear Mr. Gray:

Will you please take this as an official letter from Toronto East General Hospital indicating our willingness to participate with Knowaste Technologies Inc. in a pilot disposable diaper recycling system. It is further agreed that this program will last for ten (10) months and the proposal, accordingly to the letter from the Ministry, dated August 23, 1991. and shall commence September 1, 1991 and finish on June 30, 1992 inclusive. It is further understood that you will be collecting two (2) bags of diapers from us on a weekly basis to carry out this project and that Knowaste Technologies will contact the Hospital when you are in a position to have the bags picked up by a licensed hauler.

The hospital also reserves the right to participate with you in all documentation and statistics concerned with this pilot project and further decisions will be taken by both parties on the completion of a finalized report to the Ministry. We also wish to advise you that the contact person that you shall deal with is Mr. Dana Tulk and we suggest that you and Mr. Tulk make the necessary arrangements for pick up of the soiled product.

If there is any further information required please contact us immediately.

Yours truly

C.W.P. Van Norman
Director
Materials Management

cc/ A. Dorman, Snr. Vice President, Finance & Administration
J. Holgate, Director, Environmental Services
D. Tulk, Co-ordinator Technical Programs

CWPVN/dn



Baycrest Centre
for Geriatric Care

3560 Bathurst Street
North York, Ontario
M6A 2E1

Tel. 416-789-5131
Fax 785-2378
Donations 789-7071

August 13, 1991


Mr. D. Gray
Knowaste Technologies Inc.
969 Derry Rd., Suite 102
Mississauga, Ontario
L5T 2J7

Dear Mr. Gray:

As per our conversation on August 13, 1991, Baycrest Centre for Geriatric Care is willing to negotiate pick-up cost of disposable briefs once the pilot project is completed satisfactorily.

The cost must be less than our current pick-up, tipping, and disposal fees currently being paid.

Yours sincerely,


George Darnowski
Director
Materials Management

ENC
Knowaste

